CAN MONOTHERMAL CALORIC TESTING SAFELY SCREEN CHILDREN?

A retrospective audit of paediatric bithermal caloric tests

Author: Herra Bhutta, Anita Wong, Waheeda Pagarkar | Collaborators: Amjad Mahmood, Joseph Schneck,| Audiovestibular Medicine Department, Great Ormond Street Hospital

NHS Great Ormond Street Hospital for Children NHS Foundation Trust

100 children | **5–18 years** | **2017–2019**

BACKGROUND & AIM

Bithermal caloric testing assesses low-frequency lateral semicircular canal function using warm and cool irrigations in both ears. In children, the four-irrigation procedure can be uncomfortable and difficult to complete.

A two-irrigation monothermal screen may reduce test burden, and improve tolerability in a paediatric population, but must retain high sensitivity for abnormal canal paresis.

AIM: To evaluate the accuracy of monothermal caloric testing as compared with bithermal caloric testing in children

BSA WARM-SCREEN CRITERIA

1	**MCA <15%**	Inter-ear asymmetry within screen limit
2	**Spontaneous SPV ≤4°/s**	Minimises directional bias
3	**Each warm response >8°/s**	Helps exclude bilateral weakness

If any criterion is not met, complete bithermal testing to calculate canal paresis and directional preponderance.

METHOD

Retrospective review of 100 children who completed four water irrigations at a tertiary paediatric balance service.

1. 44°C warm and 30°C cool water irrigations
2. VNG recording of slow-phase velocity
3. Bithermal CP compared with warm and cool MCA
4. Pearson correlation; sensitivity and specificity

Included: all four irrigations completed; normal middle-ear function.
Excluded: bilateral hypofunction and spontaneous nystagmus.

COHORT

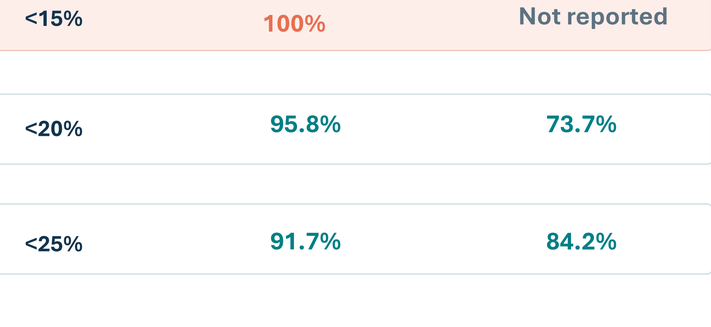
100 participants	**48 / 52** female / male
12 years median age	**24%** abnormal CP

SELECTED REFERENCES

1. Lightfoot GR et al. The derivation of optimum criteria for use in the monothermal caloric screening test. Ear Hear. 2008.
2. Adams ME, Telian SA. Historical foundations of the monothermal caloric test. Otol Neurotol. 2016.
3. Melagrana A et al. Monothermal caloric testing in children. 2003.
4. British Society of Audiology. Recommended procedure for caloric testing.
5. Gerdsen M et al. Vestibular assessment in children with sensorineural hearing loss. Front Neurol. 2024.

KEY RESULT: WARM MCA

Warm monothermal asymmetry correlated significantly with bithermal canal paresis in every subgroup.



All p <0.0001

RESULTS

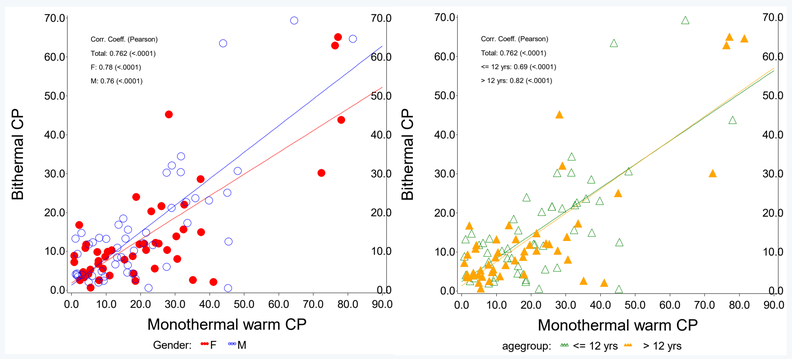
Warm MCA cut-offs

Cut-off	Sensitivity	Specificity
<15%	100%	Not reported
<20%	95.8%	73.7%
<25%	91.7%	84.2%

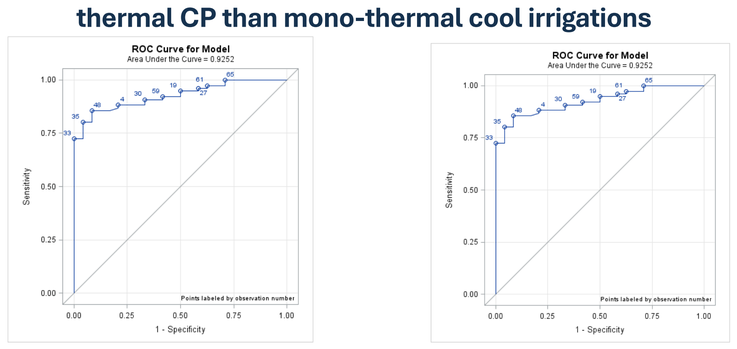
Cool MCA cut-offs

<15%	100%	49.2%
<20%	100%	67.2%

Warm irrigations showed the stronger and more consistent relationship with bithermal CP.



Monothermal warm irrigations are better correlated with bi-thermal CP than mono-thermal cool irrigations



RESULTS

A warm MCA below 15% achieved 100% sensitivity in this cohort

This supports the existing BSA screening threshold in appropriately selected children.

INTERPRETATION

Safety	The <15% threshold prioritised sensitivity and avoided false-negative bithermal classifications in this sample.
Efficiency	Higher thresholds improved specificity, but reduced sensitivity.
Temperature	Cool screening was sensitive but less specific; warm MCA was more consistent across subgroups.

PROPOSED CLINICAL PATHWAY

1. **Perform warm irrigations**
2. **Check all three BSA criteria**
3. **MCA <15% and adequate responses?**
   - **YES** → **Screen negative**
   - **NO** → **Complete bithermal testing**

LIMITATIONS & NEXT STEPS

- Retrospective, single-centre audit
- Sample of 100 completed tests
- Bilateral hypofunction and spontaneous nystagmus excluded
- Prospective validation should compare calorics with vHIT, VEMP and clinical outcomes

CONCLUSION

Warm monothermal caloric testing can be used as a screening step, not as a stand-alone replacement for the full vestibular test battery.

When MCA is ≥15%, spontaneous nystagmus exceeds the criterion, or either warm response is inadequate, complete bithermal testing.

CLINICAL IMPACT

Potentially fewer irrigations, shorter appointments and improved tolerability for children, while preserving a safety-first threshold.

Abbreviations: BSA, British Society of Audiology; BCT, bithermal caloric test; CP, canal paresis; MCA, monothermal caloric asymmetry; SPV, slow-phase velocity; VNG, videonystagmography.